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Nature relatedness in student teachers, perceived competence and willingness to teach outdoors: An empirical study

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Abstract

Despite a drive towards more learning outside the classroom, teachers' confidence to teach outdoors has been identified as a barrier to regular and positive outdoor experiences. Initial Teacher Education (ITE) has been seen as one of the ways to increase teachers' confidence, yet such provision is variable and has not been studied extensively. In this study we explore how a practical outdoor session can increase motivation to teach outdoors. Moreover, using a Self-Determination Theory framework we hypothesise that increased nature relatedness would be associated with higher perceived competence and willingness to teach outdoors. Forty-nine ITE students took part in the outdoor session, and responded to pre- and post-measures of nature relatedness, perceived competence and willingness to teach outdoors. Results suggest a positive correlation between nature relatedness and both perceived competence and willingness to undertake outdoor sessions. Moreover, nature relatedness was significantly higher after the outdoor environmental education session.

Keywords: teacher education, outdoor learning, nature relatedness, Self-Determination Theory

Introduction

Recent studies coming out of Scotland, as well as a wealth of international research, have highlighted the benefits of well-structured, quality outdoor learning experiences for children of all ages (Higgins & Nicol, 2013; Malone, 2008; Mannion, Mattu & Wilson, 2015; Pretty et al, 2009). The benefits include increased physical activity (Brown et al., 2009; Henderson, Grode, O'Connell & Schwartz, 2015; Schlechter, Rosenkranz, Fees & Dzewaltowski, 2017), and the development of a host of cognitive, non-cognitive, emotional, behavioural and social skills (Malone, 2008). A recent longitudinal, large scale study, for example, of children attending Norwegian day care centres suggests that there is a positive relationship between hours spent outdoors in preschool and several desirable cognitive and behavioural outcomes (Ulset, Vitaro, Brendgen, Bekkhus & Borge, 2017). Another study from Scotland, looked at the benefits of adventure education on social and personal skills (Scrutton, 2015). Results showed a small positive benefit post experience, but little retention after 10 weeks, thereby highlighting the importance of integration of such experiences in general teaching.

The type of environment children have access to is also important. Natural environments, for example, have been found to have positive effects on attention and could possibly be used as a preventative tool against Attention Deficit Hyperactivity Disorder (ADHD; Faber Taylor and Kuo, 2011) as well as to positive influence executive functions (Bourrier, Berman, & Enns, 2018). Moreover, regular access to green spaces in adults has been linked with increased physical and psychological well-being (Ruimtelijk, 2004), while access in childhood has been found to be associated with better psychological outcomes in adulthood (Engemann et al., 2019). A systematic literature review by Gill (2014) into the benefits of children's engagement with

nature brings forth several interesting messages, that are well supported by the literature. These include pro-environmental attitudes in adulthood for those who spent more time outdoors as children (Chawla, 1999; Ewert, Place & Sibthorp, 2005; Wells & Lekies, 2006), and that spending time in nature is associated with better mental health and emotional regulation (Korpela, Kyttä, Hartig, 2002). In his review, Gill (2014) highlights other claims with some support within the literature, such as specific types of engagement, like gardening, or forest-school being associated with benefits, such as increased self-esteem. Finally, a more recent review of the literature attempted to identify the role of experiences in nature in promoting learning (Kuo, Barnes & Jordan, 2019). The report finds strong evidence, including experimental evidence, to support the role of nature and proposes several mechanisms for this. These include increased attention and reduced stress, better self-discipline as well as increased interest and enjoyment of learning (Kuo et al., 2019).

While outdoor learning and teaching in natural settings has come to be seen as an important part of practice and policy in both Scotland (Christie, Higgins and Nicol, 2015) and the rest of the UK (Ofsted, 2008), Scotland, is considered to be one of the pioneering countries in the formalisation of outdoor education provision (Higgins, 2002). This has continued, with outdoor learning having a valued place within Curriculum for Excellence (CfE; Education Scotland, n.d.). In late 2018 guidance was published by the Scottish Government on the ways that meaningful outdoor learning experiences could be created, further encouraging practitioners to use the outdoors (Scottish Government, 2018) However, there is no longer a statutory requirement for schools and teachers to provide such experiences, and much still depends on the setting and practitioner's willingness to undertake such teaching and learning experiences (Beames, Atencio & Ross, 2009). While barriers often include cost and accessibility of

appropriate spaces, evidence from the rest of the UK suggests that another key barrier can be the teachers' confidence[2] in their ability to plan and deliver such experiences (Nundy, Dillon & Dowd, 2009; O'Donnell, Morris & Wilson, 2006).

Increasing training opportunities for teachers would aid in equipping them with the necessary knowledge, skill and understanding to plan and safely undertake positive outdoor learning experiences. A similar call has been made in the US, relating to environmental education (EE) within teacher education (Franzen, 2017). In this regard Initial Teacher Education (ITE) programmes have been identified as a key way to build such skills and confidence in student teachers (University of Edinburgh, 2016), alongside other opportunities such as continuous professional development. Moreover, the same report from the University of Edinburgh (2016) emphasises the need for providers to "establish a research informed approach to such provision" (p. 3). However, such provision of outdoor learning experiences as part of university-based ITE is not a requirement for programmes in Scotland, or the rest of the UK. This study aims to examine the effectiveness of this type of provision of outdoor learning experiences, in relation to increasing student teachers' and perceived competence and motivation to teach outdoors. Furthermore, this study is an attempt to further add to the research-based approach to teacher education, and in particular with regards to outdoor learning.

One of the oft-stated aims of learning outdoors in natural environments is to gain a deeper understanding of issues relating to sustainability (Higgins, 2009; Higgins & Kirk, 2006; Irwin, 2008). This is because positive outdoor experiences are perceived as helping to build a

[2] The word 'confidence' is used here, as it is the term that is used in the outdoor learning literature cited. However, in the rest of the article, the more precise term, and construct within Self-Determination Theory of, 'perceived competence' will be used. Perceived competence is the subjective understanding of one's skills, whether the individual feels they have the attributes and skills necessary in order to success in a specific task or situation (Kremer, Moran, Walker & Craig, 2011).

constructive relationship with our environment and nature, which is key to fully understanding and enacting sustainability (Palmer & Suggate, 1996). Our affective relationship with nature, rather than knowledge alone, has been linked to pro-environmental behaviours and attitudes (Nisbet, Zelenski & Murphy, 2009) with a recent study suggesting that it is in fact our connection to nature rather than knowledge of nature that is stronger associations with ecological behaviour (Otto & Pensini, 2017). Because of the relationship between nature connection and our sustainability beliefs and behaviours, nature connectedness has been recognised as an important goal of environmental education programmes (Frantz & Mayer, 2014). Moreover, it has further been identified as a central aim of

of outdoor learning (Barrable & Arvanitis, 2018).

By focusing on a pedagogy for nature connection in outdoor learning, we are strengthening the link between outdoor learning and learning for sustainability. Given the relationship between nature connection and several desirable cognitive and behavioural aspects, as demonstrated by previous studies (Kals, Schumacher & Montada, 1999; Nisbet et al., 2009; Mayer & Frantz, 2004) we can bring forward the hypotheses that nature relatedness would correlate positively with student teachers' perceived competence and willingness to teach outdoors.

There has been a call for literature that examines the type of experiences that lead to increases in relatedness with nature (Zylstra, Knight, Esler & Grange, 2014). In this context two types of routes have emerged: one relating to direct experience and contact with nature, and one relating to gaining information about nature. Actual contact, in the form of being outdoors in natural environments, has been found to have a strong association with nature relatedness (Arbuthnott, Sutter & Heidt, 2014; Hinds & Sparks, 2008; Kals et al., 1999). In one study, simply taking a short walk (15 mins) in nature was found to increase connection to nature in adults significantly

more than an urban walk or virtual exposure to nature (Mayer, Frantz, Bruehlman-Senecal & Dolliver, 2009). On the other hand, learning about nature and the environment, e.g. through environmental education projects, has also been found to have an effect on how connected we feel to nature in adults and older children (Arbuthnott et al., 2014; Ernst & Theimer, 2011; Mace, Woody & Berg, 2012). However, it should be noted that although there may be short-term increases in our nature relatedness after environmental education programmes, these may not be sustainable. In a 2013 study of both children and adults who took part in an Environmental Education programme, while there was a robust increase of connection to nature in both, at a four-week follow up, only children seemed to sustain this increase (Liefländer, Fröhlich, Bogner, & Schultz, 2013).

Theoretical framework

Self-Determination Theory (SDT) is an organismic theory of human growth and motivation (Ryan & Deci, 2017). SDT posits that humans have three innate basic psychological needs: autonomy, competence and relatedness (Deci & Ryan, 2000). Autonomy relates to humans' need to feel that they are determining their own behaviour (Ryan & Deci, 2006). Competence is the basic psychological need of humans to feel that they are achieving mastery (Adams, Little & Ryan, 2017). Finally, relatedness is our need to feel connected to others and part of a greater social context (Deci, Ryan & Guay, 2013). These three needs are closely interconnected, as well as associated with our personal motivation (Deci & Ryan, 2000).

Although SDT has been used extensively in educational contexts, the focus has been on the motivation of pupils to learn (Deci, Vallerand, Pelletier & Ryan, 1991; Grolnick & Ryan, 1987) teachers' motivation has not been studied as closely. A recent qualitative study has used SDT to look at teachers' motivation in teaching outdoors (Barfod, 2018) which placed great emphasis on

both teachers' decision making (autonomy) and the social relatedness of teachers, through building of professional networks. The study by Barfod (2018) further highlighted the importance of social relatedness as a contributing factor to increased motivation in relation to outdoor learning. Building on that study, our own work aims to look at motivation for teaching outdoors using the same framework but a quantitative methodology. Moreover, we aim to further expand the construct of relatedness past social relatedness, and include nature relatedness, the extent to which an individual feels close to nature, as an additional variable. We hypothesised that feeling closer to nature, i.e. a higher degree of nature relatedness, would be correlated with student teachers' motivation to undertake activities outdoors, mirroring Barfod's findings of higher degrees of social relatedness increasing such motivation. Moreover, NR has in the fact been associated with behavioural aspects of wanting to spend more time in nature, as well as being interested in natural processes, and wanting to protect it (Nisbet et al., 2009).

The second psychological need that the study aims to address is that of competence. Competence is explained as one's feeling of being able to tackle the challenges that are presented to them (Niemic & Ryan, 2009). An association between perceived competence and motivation has been observed before (Jaakkola, Washington, & Yli-Piipari, 2013) suggesting that the more competent someone feels to undertake a task, the more likely they are to be willing to do so. Change of behaviour within SDT has been observed to occur as a function of two processes: the internalisation of autonomy (i.e. the person feels the behaviour is self-determined, driven by the self) and competence (Williams et al., 2006). Through a subjective improvement of a particular skillset perceived competence can increase, and with it the motivation to undertake similar tasks.

In this study we focused on NR, perceived competence and willingness to teach outdoors. Given the associations between time spent outdoors, and nature relatedness (Nisbet et al., 2009) and past studies that have shown outdoor environmental education programmes can increase nature connection (Ernst & Theimer, 2011), we hypothesised that such a session would significantly increase the participants' subjective feelings of being connected to nature, as measured using the Nature Relatedness (NR) scale (Nisbet et al, 2009). Moreover, familiarising students with and modelling activities that could be performed outdoors, we proposed that students' perceived competence and willingness to teach outdoors would also increase.

Hypotheses:

For this research paper we are making the following hypotheses:

1) There is a correlation between nature relatedness and perceived competence to teach effectively outdoors.
2) There is a correlation between nature relatedness and willingness to teach outdoors.
3) There is an increase in nature relatedness after the outdoor environmental education session.
4) There is an increase in perceived competence to teach outdoors after the outdoor environmental education session.
5) There is an increase in willingness to teach outdoors after the outdoor environmental education session.

Method

Participants

A total of *n*=49 participants, who were all student teachers on the primary undergraduate or postgraduate programme, took part in the study. Two groups of participants were recruited, both of which were student teachers. All participants took part in an outdoor session. The first group (*n*=34) consisted of second year undergraduates on a four year teacher education programme (MA Hons). While the entire year group were invited to participate (*n*=61), only 34 students (55.74%) participated in both the pre- and post-session measure. The second participant group consisted of student teachers taking an Environmental Sciences elective as part of their one-year postgraduate primary education programme (PGDE) at the same university. Of the 17 students who took part in the elective (*n*=15) 88.24% responded in both the pre- and post-session questionnaires. For the collective participants (*n*=49), 83.7% were female (*n*=41) which presents a close representation of the male/female ratio for the teacher education programmes overall, which is 1/10. The mean age of all participants was 24 years (SD=7.04), with a range of 19 to 47 years. Although all 49 student teachers took the pre-session questionnaire, only 43 returned for the post-session presenting an attrition rate of 12%.

Participants were recruited via the university email system, although there was also a verbal invitation extended by both researchers during their direct contact with the students. A reminder email was sent before the outdoor session took place, and two reminders were sent post-session. Email was used in order to get maximum response (Lonsdale, Hodge & Rose, 2006), as well as for cost purposes.

The session

The outdoor sessions took place at the local Botanic Garden which is frequently used by neighbouring schools, both primary and to a lesser extent, secondary. It has an education officer and a well-resourced education programme. The aim of the session was two-fold:

(i) to introduce ITE students to the educational facilities and opportunities afforded by the Garden with a view to enabling the students to appreciate the potential such a resource offers to outdoor learning,

(ii) for the students to partake in two hands-on activities, thereby experiencing for themselves the potential of outdoor learning, whilst appreciating the various organisational practicalities that need to be considered from a teaching perspective.

The session began with a brief overview of the facilities and resources available by the Education Officer. He explained the nature of one activity the students were to undertake: 'Plants for people trail'. The students were to put themselves in the role of the children, exploring the garden through the guidance and instruction of this education initiative.

The second activity involved the students contributing to some on-going research undertaken in the Garden on the diversity and composition of the two non-native ponds. This entailed carrying out some pond-dipping; itself a highly motivating activity (Lakin, 2013). Before embarking on the activities, a detailed discussion developed on managerial logistics, health and safety precautions and assessments, as well as opportunities for learning and the role of the teacher in guiding and scaffolding the process.

The whole session took three teaching periods (180 minutes) and concluded with a plenary encouraging the students to recount and externalise their own learning throughout from the perspective of both teacher and student. They were also encouraged to consider feelings and emotions encountered especially in terms of 'equableness of opportunity' from the recipient's perspective of the experience and possible consequences this may present in terms of behaviour and contribution.

Ethics

Full ethical approval was obtained prior to the start of the data collection, from the University of Dundee School of Education and Social Work ethics committee and in accordance with University non-clinical research ethics procedures. Informed consent was sought and freely given by all participants before the commencement of data collection.

Measures

The following variables were operationalised for this study: nature relatedness, perceived competence to teach outdoors and willingness to teach outdoors. In addition, a series of other questions were included, such as gender and age, course currently enrolled in, previous outdoor teaching experience, and hours spent outdoors per week. The latter two questions had an open response box for free text. The question relating to experience of teaching outdoors had a further clarification, urging student teachers to include experience they might have had during their university teaching placements and/or as camp leaders etc.

Nature relatedness

There are many validated scales that measure nature relatedness as a construct, including the Nature Relatedness scale (NR; Nisbet et al, 2009), the Connectedness to Nature Scale (CNS; Mayer & McPherson-Frantz, 2004) and the Inclusion of Self in Nature (INS; Schultz, 2002). Of those we chose to use the NR scale, which has been used in the past to measure nature relatedness both as a trait and state level (Lumber, Richardson & Sheffield, 2017). It is correlated with time spent outdoors (Nisbet et al, 2009), and has also been used to measure changes in the subjective feeling of being connected to nature after an experience (Lumber et al, 2017). The full

scale, of 21 items, contains three subscales of self, experience and perspective. Items consist of statements e.g.

- ‘I am aware of environmental issues’
- ‘I am not separate from nature, but a part of nature’, and
- ‘ I enjoy being outdoors, even in unpleasant weather’

Responses are measured on a 5-Likert scale ranging from [1] ‘disagree strongly’ to [5] ‘agree strongly’. Finally, it has good internal consistency (α=.87).

Perceived Competence Scale

The Perceived Competence Scale (PCS) is a family of short, 4-item questionnaires designed to assess how competent a person perceives themselves to be in relation to a particular behaviour, such as learning course (PCS for Learning) materials or participating in physical activity. For the purposes of our study, we constructed a scale by adapting the PCS for Learning (Williams & Deci, 1996). The scale has four items e.g.

- ‘I feel confident in my ability to learn this material’ and,
- ‘I feel able to meet the challenge of performing well in this course’

All four items were adapted to apply to teaching outdoors e.g. ‘I feel confident in my ability to deliver quality outdoor learning experiences’ and ‘I feel able to meet the challenge of delivering meaningful lessons in nature’. We called the new scale Perceived Competence to teach Outdoors (PCTO).

The responses are given in a 7-point Likert scale ranging from [1] -not at all true’ to [7] -very true’. The PCS for Learning has a high internal consistency with an alpha measure of .80 (Williams & Deci, 1996).

Willingness to Teach Outdoors (WTO)

In order to see whether the outdoor session had an effect on student teachers' willingness to plan and deliver outdoor teaching activities, we created a 3-item scale that pertained to the likelihood that they would incorporate outdoor experiences into their learning. The first item related to general outdoor activities ('I will be incorporating outdoor learning experiences into my teaching'), while the other two were specific to Science Technology Engineering and Mathematics (STEM) subjects ('I will be teaching STEM-related subjects outside') and other curriculum subjects ('I will be planning and delivering outdoor learning experiences for other subjects within the curriculum'). The inclusion of a question particular to STEM aimed at elucidating whether receiving a science-based input would make a difference to student teachers' willingness to teach such subjects outdoors. Moreover, student teachers in Scotland have been reported as finding STEM subjects more challenging to teach (Education Scotland, 2013). To keep the format consistent with the previous question we kept the answer as a 7-Likert scale ranging from [1]-rarely' to [7]-Very often').

Analysis

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 22.0. Initially descriptive statistics were calculated and are presented below. As the data were initially explored using the Shapiro Wilk test of normality, NR was found to not be normally distributed (p=.003). Perceived Competence had a normal distribution (p=.849), while Willingness to Teach Outdoors was not normally distributed (p= .006). For that reason, non-parametric tests were used for all analyses that included NR and WTO. In order to investigate whether there is a correlation between NR and firstly, PCTO and then WTO, Spearman's rho test was performed. To determine whether there was a statistically significant change in the means

between our pre- and post-session measures for NR and WTO, we performed the Wilcoxon Signed Ranks Test, as the sample was paired and the data not normally distributed. All p-values were two-tailed. Finally, in order to calculate whether there is a significant change between the pre- and post-session values for Perceived Competence we used a paired t-test and calculated the effect size using Cohen's *d.*

Results

Descriptive statistics

The total mean NR of the whole sample (*n*=49) was calculated at M=3.56 (SD=.70). The means for males (*n*=8) and females (*n*=41) were also calculated, with males having a mean of M=4.24 (SD=.31) and females M=3.48 (SD=.67). A *t* score was not calculated for this difference, as the number of males was too small. However, an independent samples t-test was used, in order to see whether there was a significant difference between undergraduate students, on the four year ITE programme, and students on the postgraduate, one-year course. There was a significant difference between the mean in the undergraduate cohort (M=3.42, SD=.71) and their postgraduate peers (M=4.02, SD=.36); *t* (47)=-3.12, *p*=.003. Looking at the qualitative data that they provided, in terms of previous experience, 20 out of 39 MA students (51.3%) reported having some prior relevant experience, while 8 out of 17 PGDE (47%) students reported having similar. The rest of the cohort either answered 'No' or provided no answer. The experiences that were included were having been a scout or camp leader, as well as outdoor learning experiences during placement.

The mean for PCTO was calculated at M=3.46 (SD=1.19), while the respective means for males and females were, for males M=3.68 (SD=.94) and for females M=3.41 (SD=1.25). The mean for undergraduates (M=3.31, SD=.20) and postgraduates (M=3.8. SD=1.21) was also calculated, as well as the difference between the means using an independent samples t-test (t (47)=-1.31, p=.19). The difference was not found to be significant.

For WTO the mean was calculated at M=3.36 (SD=1.57). Means for males (M= and females (M= were calculated, as well as for different cohorts. The undergraduate mean was 3.10 (SD=1.51), while the postgraduate was M=3.96 (SD=1.59). The difference was not found to be significant (t (47)=-1.80, p=.08).

Finally, while looking at the descriptive statistics, we looked at whether there was a correlation between time spent outdoors and reported NR. Spearman's rho correlation coefficient was calculated at r=.45, p=.001, suggesting that, as previous research has shown there is a positive correlation between these two variables.

Internal consistency measures for the scales

Cronbach's alpha scores were calculated for the NR and the PCTO used in this study. The internal consistency for the NR in this study was very high, at α=.88. For the adapted PCTO scale used in this study Cronbach's alpha was calculated at α=.78. Both rates are generally acceptable, being above α=.70 (Cortina, 1993). Cronbach's alpha was not calculated for the WTO, because was not judged to be a relevant measure for this scale, as the WTO is not uni-dimensional.

Inferential Statistics

NR and perceived competence and willingness to teach outdoors

The first two hypotheses looked at the relationship between NR and the student teachers' perceived competence and willingness to teach outdoors.

To examine hypotheses 1 and 2 Spearman's rho correlations were performed. A significant positive correlation of r (47)=.34, p=.018 indicates that there is a positive association between student teachers' NR and their perceived competence to teach outdoors. Similar results were found when looking at NR and student teachers' willingness to undertake outdoor teaching activities, with a significant positive correlation of r (47)=.40, p=.005 between NR and reported willingness.

Changes in NR before and after session

Hypothesis 3 stated that there will be a positive change in NR after an outdoor environmental education session. The mean NR score before the session was M=3.56 (SD=.70). Post-session results for NR has a mean of M=3.66 (SD=.71). As the NR data were explored and found to not be normally distributed a Wilcoxon Signed Ranks Test was performed. It indicated that NR was significantly higher after the outdoor session than before (Z=3.45, p=.001). The null hypothesis can be rejected.

Changes in perceived competence before and after session

The fourth hypothesis predicted that there would be a positive change in student teachers' perceived competence to teach outdoors between the pre and the post-session measures. A paired samples t-test was performed, followed by a Cohen's D to measure effect size. For this question we report both the mean score, as well as the individual question scores, giving us an idea of

which areas of instruction and planning were most affected by the session that was delivered. The results are presented for each question, as well as for the total score, in Table 1 below.

Insert Table 1 about here.

Results showed that there was a significant change between pre- and post-session measurements of perceived competence to teach outdoors for three out of the four questions, as well as overall.

Changes in willingness to teach outdoors before and after session

The final hypothesis stated that there would be a positive change between students' willingness to teach outdoors before and after the session. Given the fact that the data were not normally distributed, the Wilcoxon Signed Ranks Test was used in this instance. The results are presented in Table 2 below, by question and include the total.

Insert Table 2 about here.

Discussion

Our results indicate that there is a positive correlation between how close student teachers feel to nature (NR) and how competent they perceive themselves to be in undertaking outdoor teaching sessions. In addition, NR is also positively correlated to their willingness to teach outdoors. The outdoor environmental session that our respondents engaged in had a significant positive effect on their NR. There was also a robust increase in participants' perceived competence and willingness to teach outdoors, as measured in this study.

More specifically, we had hypothesised that, given the cognitive and behavioural correlates of NR, for example spending more hours outdoors and valuing the environment (Nisbet et al,

2009), student teachers with higher NR would feel a closeness to the environment and greater ease with being outdoors. This would be likely to affect how willing they would be to undertake outdoor learning sessions.

The study found significant differences between the two cohorts that took part, the second year undergraduate students completing the four-year MA programme, and the postgraduate one-year students. The latter were found to have a significantly higher NR, which is possibly due to the fact that the PG cohort were recruited from an Environmental Scienceselective, and are therefore more likely to have an interest in environmental issues and nature. This study also found a positive correlation between time spent outdoors and NR, as would have been expected from previous literature that links these two variables (Nisbet et al, 2009). As mentioned above, no significance difference was found between prior experiences with outdoor learning in the undergraduate and postgraduate groups, that would explain a possible difference in the scores.

Previous studies have indicated that limited training is a barrier to teacher confidence to undertake outdoor sessions (Hanna, 1992), and that further training could be critical in building such confidence (O'Donnell et al., 2006; Lakin, 2013). The present study further supports that and indicates that even short (three-hour) outdoor sessions could have an effect on student teachers' perceived competence in taking their pupils out of the classroom. An interesting anomaly should be mentioned here: although student teachers' Perceived Competence to Teach Outdoors on the whole significantly improved between before and after participating in the outdoor session, although one item in particular showed no significant change. In response to statement "I am confident in my ability to deliver outdoor experiences", although scores improved between pre and post measurements, they were not significantly different. We hypothesise this might be to do with the particular phraseology used in this question, and

potential with the use of the word ‘confident’. In future, alternative wording could be provided, using the words ‘able’ or ‘capable’. The rest of the statements, which were similar all showed a significant difference between the two points in time.

The study also found that students’ willingness to teach outdoors significantly changed after their participation in the outdoor experience. However, in this case there was an exception that is worth mentioning. For item 2 (“I will be teaching STEM through outdoor learning”) there was no significant (p=.852) change recorded between pre- and post-experience measurements. We can only hypothesise that, although student teachers’ general willingness to take their classes outdoors, as well as their willingness to teach other curricular subjects increased, the prospect of teaching STEM related outdoor sessions may appear more daunting. This is likely to be related to a lack of confidence and general reticence of teachers to teach STEM subjects (Education Scotland, 2013). More focused research could illuminate this point further.

Several limitations need to be considered at this stage. A more robust study design that included a control group would have been good in increasing the reliability of the study, but was not possible in the current one. However, the fact that we can compare pre- and post-activity in a within samples design can offer evidence that the changes seen in the measurements taken before and after are indeed due to the experience, rather than an inherent difference in the sample chosen.

Although we acknowledge a bias in the sampling of the postgraduate cohort, as these were students who had actively elected to take part in a module on the teaching of Environmental Sciences. The module outline indicated that a workshop session at the Botanic Gardens was a compulsory part of the course. The differences in NR between that group and the undergraduate cohort were examined above and were found to be significant, suggesting that the students who

had chosen the elective were perhaps already positively predisposed towards outdoor learning than the average student teacher. However, the changes between before and after measurements were significant, suggesting that regardless of initial level of NR in students teachers and predisposition to teach outdoors, the experiential session could have a positive effect. Finally, a follow-up of participants, i.e. retaking the measures, after a period of 4 to 6 weeks, could further indicate whether the changes observed in NR, perceived competence and willingness to teach outdoors between pre- and post-session persisted over time. Future studies could follow participants into their school placements, to see if there were observable differences in the actual incidence of outdoor teaching between teachers who had undertaken such practical sessions, and teachers who had no such experience.

Conclusion

With a greater movetowards outdoor learning for all and the need for environmentally-responsible citizenship to be developed, good quality, positive outdoor experiences are crucial Education Scotland, n.d.). However, outdoor education provision in teacher education programmes in higher education has not been studied widely to date. The experiences provided by initial teacher education institutions vary widely in both quality and quantity, as well as in mode of teaching (Stevenson, Brody, Dillon & Wals, 2013).

In the current study we aimed to investigate one such learning experience and evaluate its efficacy. Moreover, we wanted to explore nature relatedness, a positive construct that is not only associated with increased well-being and pro-environmental beliefs, but also with behavioural elements, such as spending more time outdoors and acting in an environmentally responsible way (Nesbit et al, 2009, Capaldiet al., , 2014). Nature relatedness has further been identified as a worthwhile aim for outdoor learning experiences and programmes (Barrable & Arvanitis, 2018),

and has also been used a possible metric of success in outdoor sessions that aim to encourage people to come closer to nature and perhaps change their attitudes and behaviour towards the environment (Ernst & Theimer, 2011).

Although the authors acknowledge that more research is needed into the types of experiences that can build teachers' perceived competence in delivering diverse outdoor experiences of high quality, this study suggests that outdoor sessions, that encompass practical and pedagogic elements of environmental education could be useful in empowering teachers to take their classes outdoors. Moreover, the present study adds to the literature both in theoretical and practical terms. In terms of theory, it proposes a positive association between nature relatedness in student teachers and their perceived competence and motivation to take teaching outdoors. In terms of practice, this should encourage ITE programmes in future to see nature relatedness as a way to nurture teachers' passion for outdoor learning and the outdoors.

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